



WEST VIRGINIA WATERSHED ASSESSMENT PILOT PROJECT



Gauley River ©Kent Mason

Monongahela Stakeholder & End User Workshop
April 3, 2012



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Presentation Outline



- Project Background
- Methodology & Model Structure
- Metrics
- Relative Ranking Results
- Interactive Web Tool Overview & Examples

Project Background

1. Objectives
2. Study Area
3. Timeline

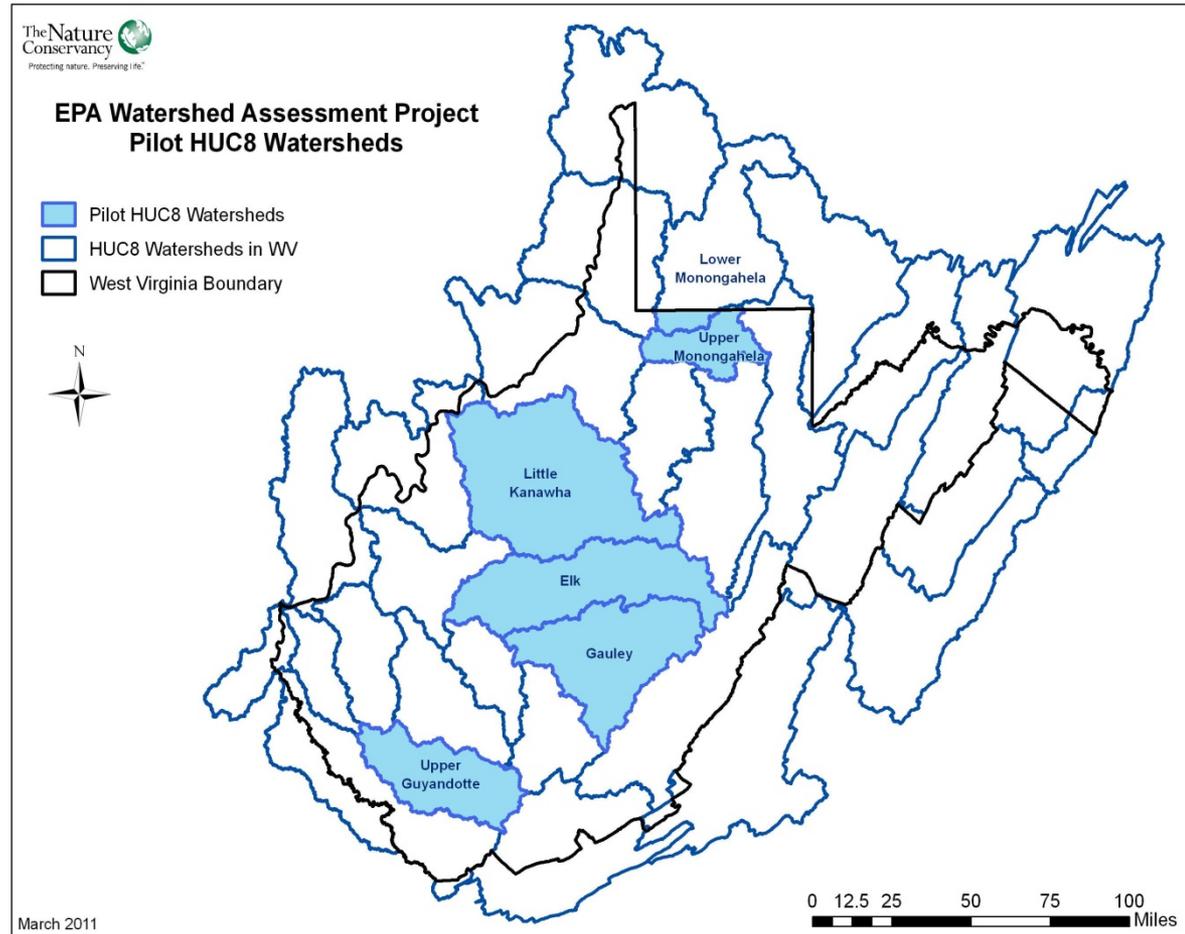
Project Objectives

- Design and test a watershed assessment process that can be replicated in WV's remaining watersheds
- Find datasets & develop metrics to measure Current Condition/Function & Future Threats
- Rank planning units in terms of Restoration & Protection Priorities
- Provide a decision support tool to assist partners, stakeholders, and regulatory staff with decisions affecting aquatic resources
- Identify data gaps & data needs

Project Study Area

Five WV HUC8
Watersheds:

- **Monongahela**
- **Elk**
- **Gauley**
- **Little Kanawha**
- **Upper
Guyandotte**



Project Timeline

- First 2 Watersheds:
 - 4/1/2011 – Project Start
 - 6/13/2011 – Technical Advisory Team Meeting
 - 10/24 & 25/2011 – Expert Workshop #1
 - 1/31/2012 – Expert Workshop #2
 - 4/3 & 5/2012 – Stakeholder/Partner Workshops
 - 6/1/2012 – Draft Watershed Reports completed
- Final 3 Watersheds:
 - 6/1/2012 - Start
 - By 10/1/2012 - Expert Workshop #1
 - By 12/1/2012 - Expert Workshop #2
 - By 2/1/2013 - Stakeholder/Partner Workshops
 - 4/1/2013 – Final reports & interactive web application completed

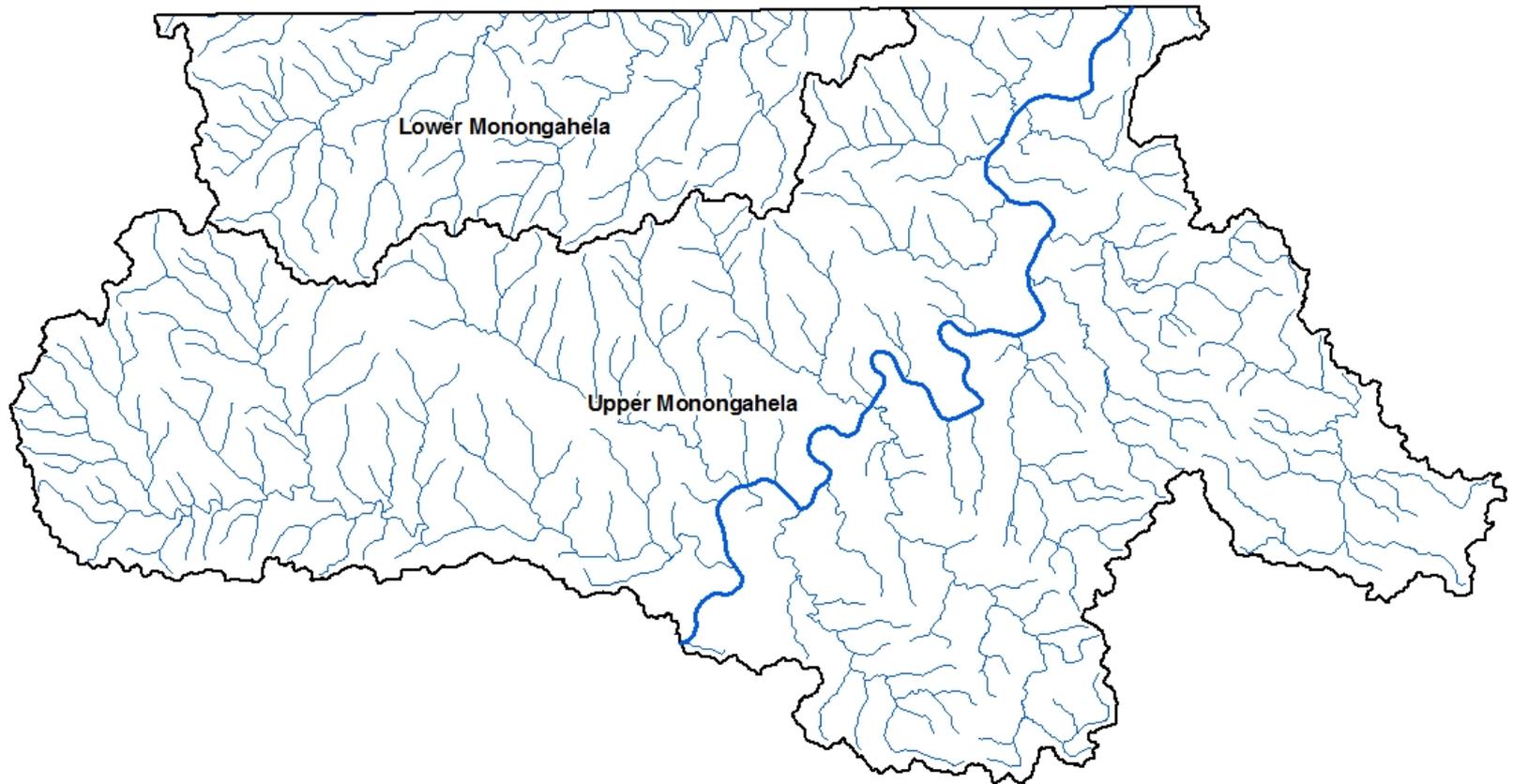
Methodology

1. Planning Units
2. Model Structure
3. Prioritization Methods
4. Datasets & Metrics

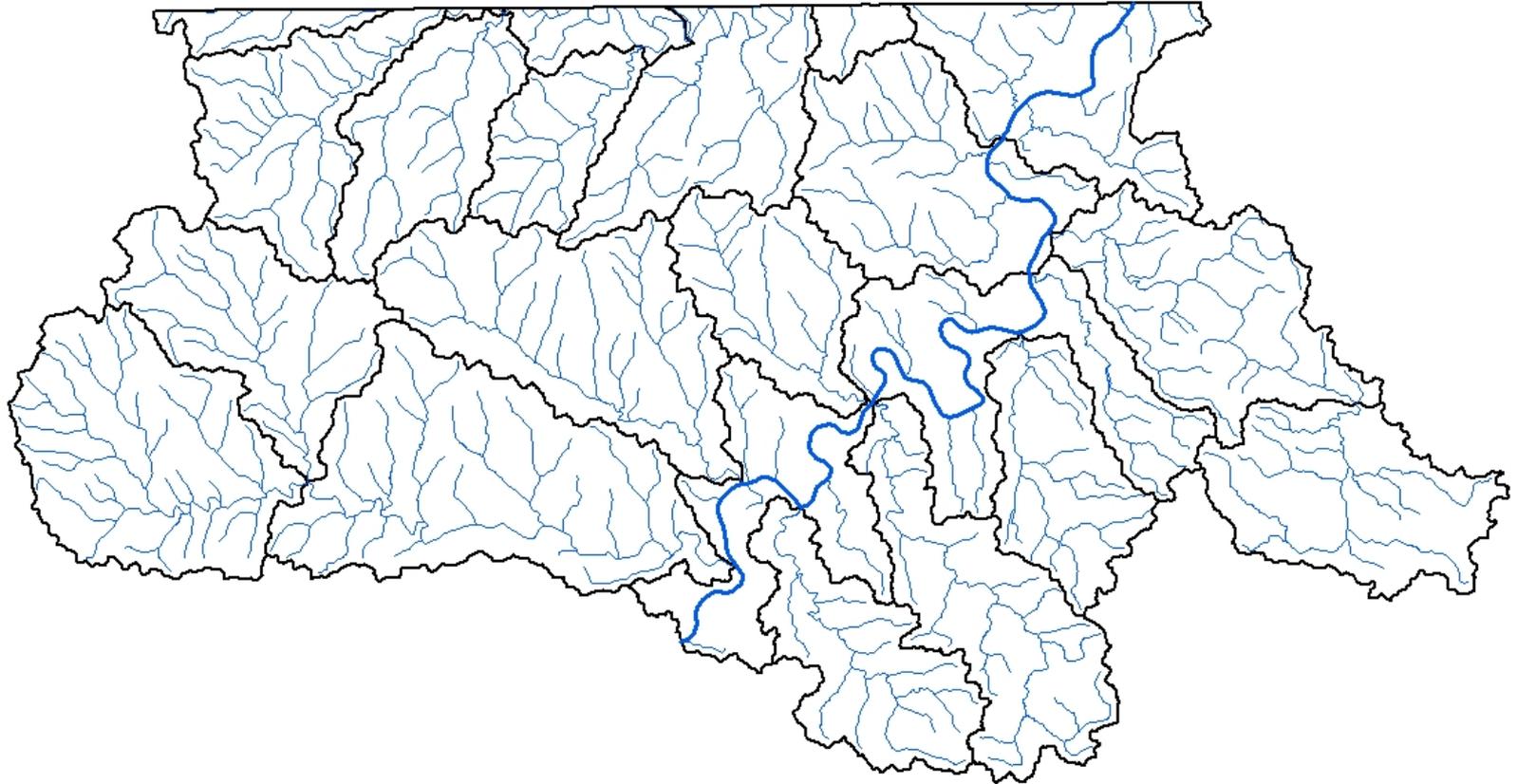
Watershed Characterization

- Two Scales of Planning Units:
 - HUC-12 watersheds
 - Catchments

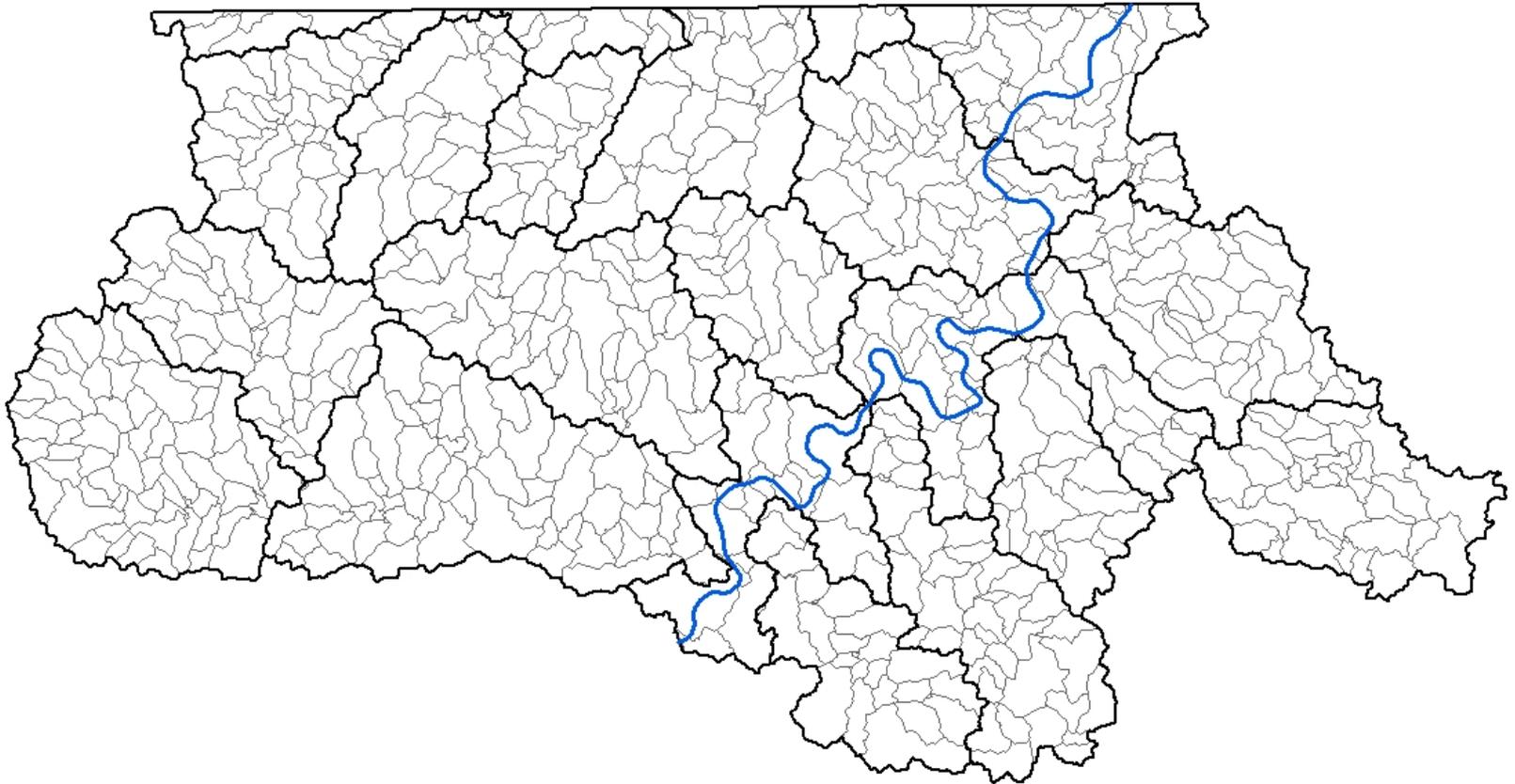
Upper & Lower Monongahela HUC8 Watersheds



Planning Units: HUC12s



Planning Units: Catchments



Planning Unit Prioritization

- **Phase I:**
 - Ranking of planning units according to current Condition/Function
- **Phase II – Consolidated Analysis:**
 - Cumulative Watershed Effects
 - Historical and Future Conditions
 - Evaluate target areas within planning units

Model Structure

Hierarchical Structure:

- 3 Models:
 - ▣ Streams
 - ▣ Wetlands
 - ▣ Uplands
- 2 Categories:
 - ▣ Condition/Function
 - ▣ Consolidated Analysis
- Several Indices per Category
- Multiple Metrics to define each index

**STREAMS/ RIPARIAN
PRIORITY MODEL**

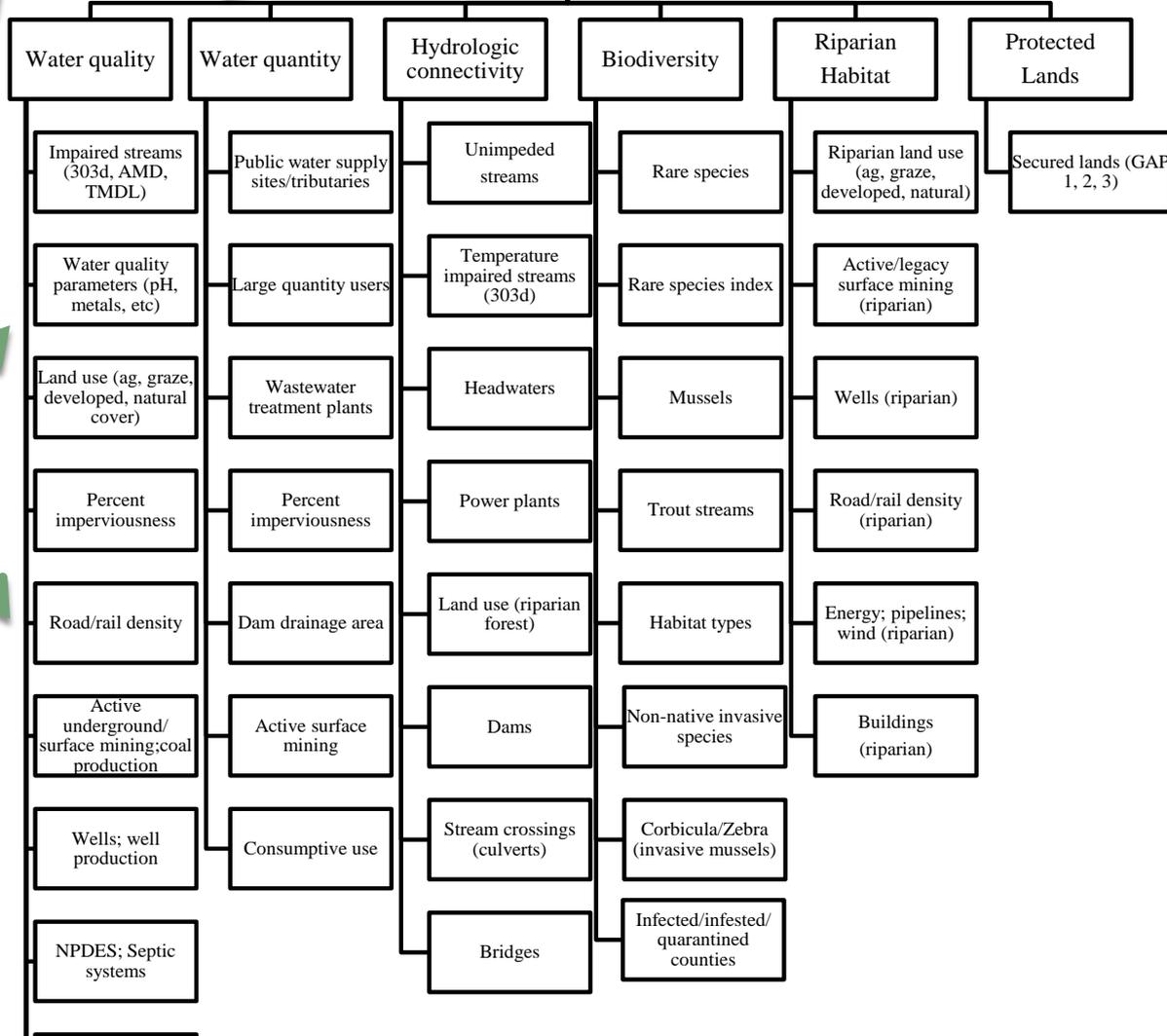
1 of 3 Models

**CONDITION/
FUNCTION**

Category

Index

Metrics



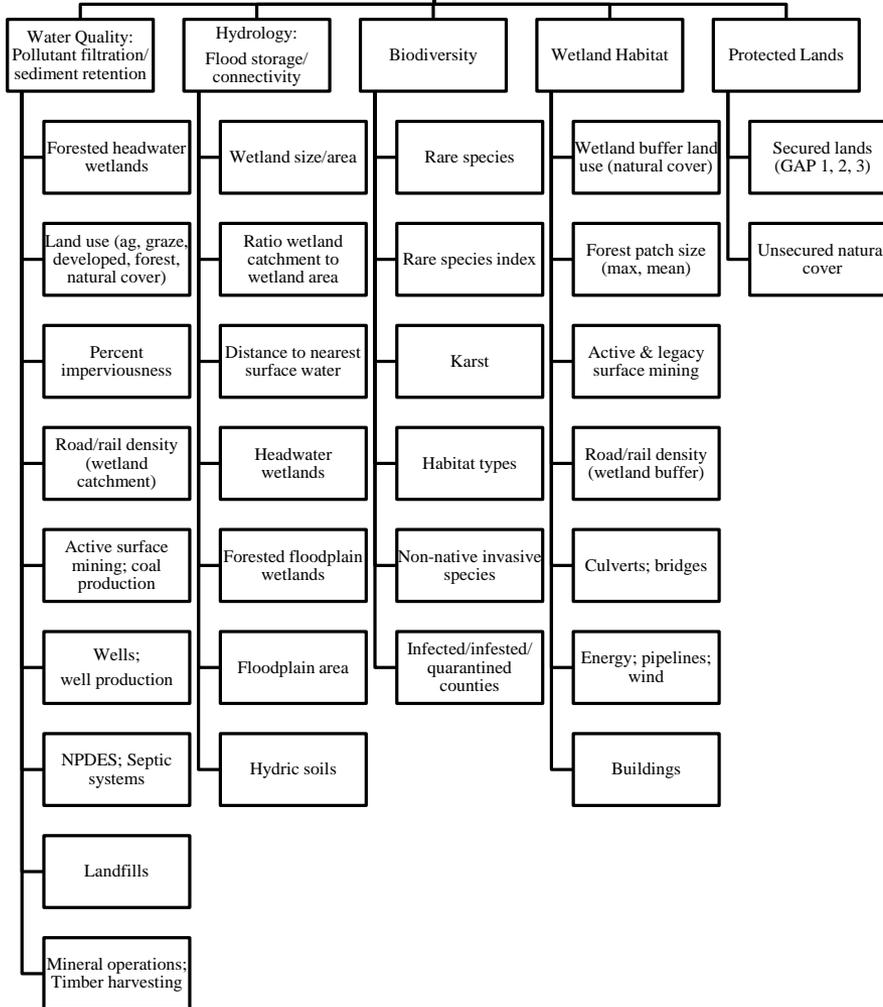
1 of 3 Models

WETLANDS PRIORITY MODEL

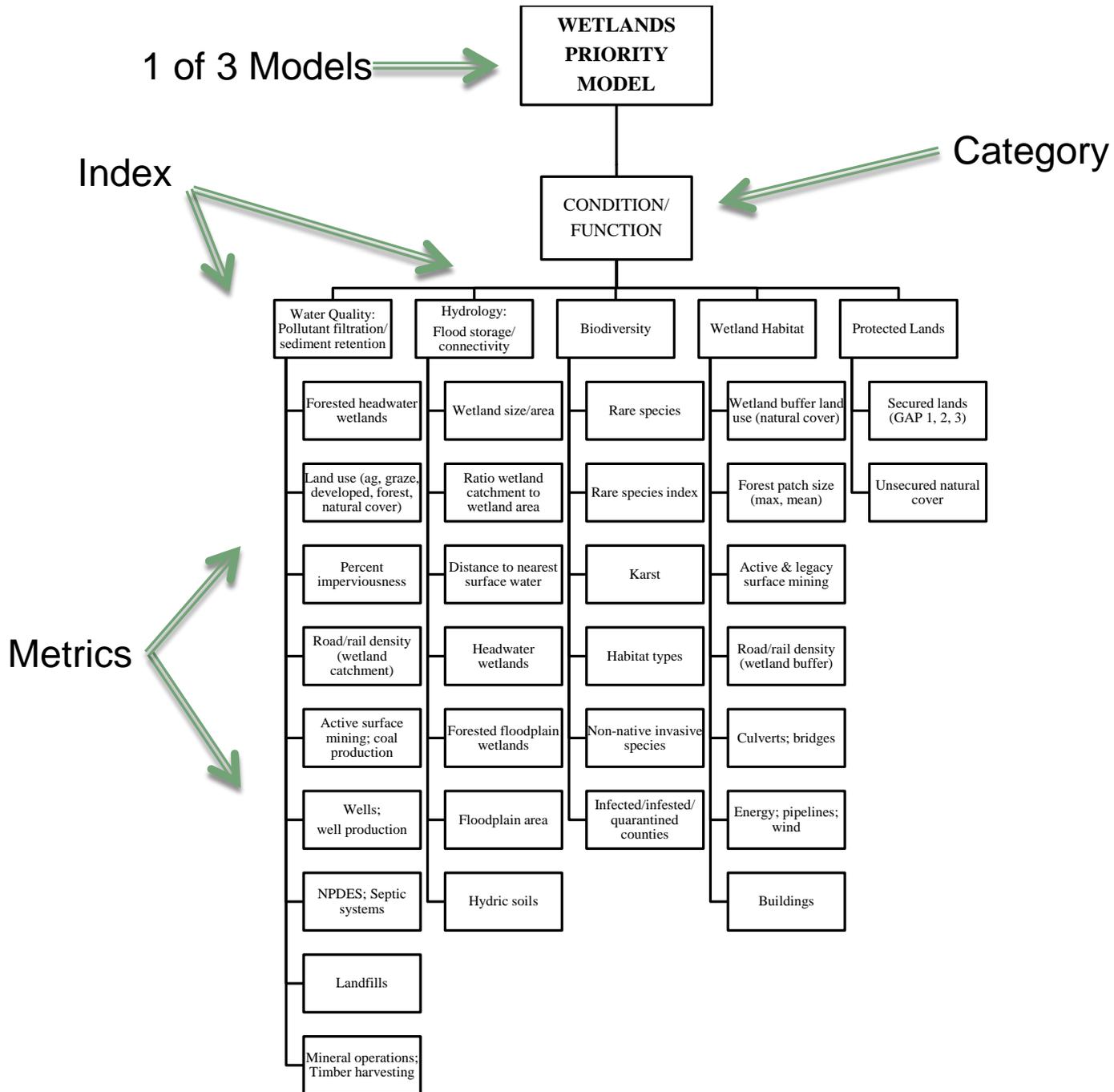
Index

Category

CONDITION/ FUNCTION



Metrics



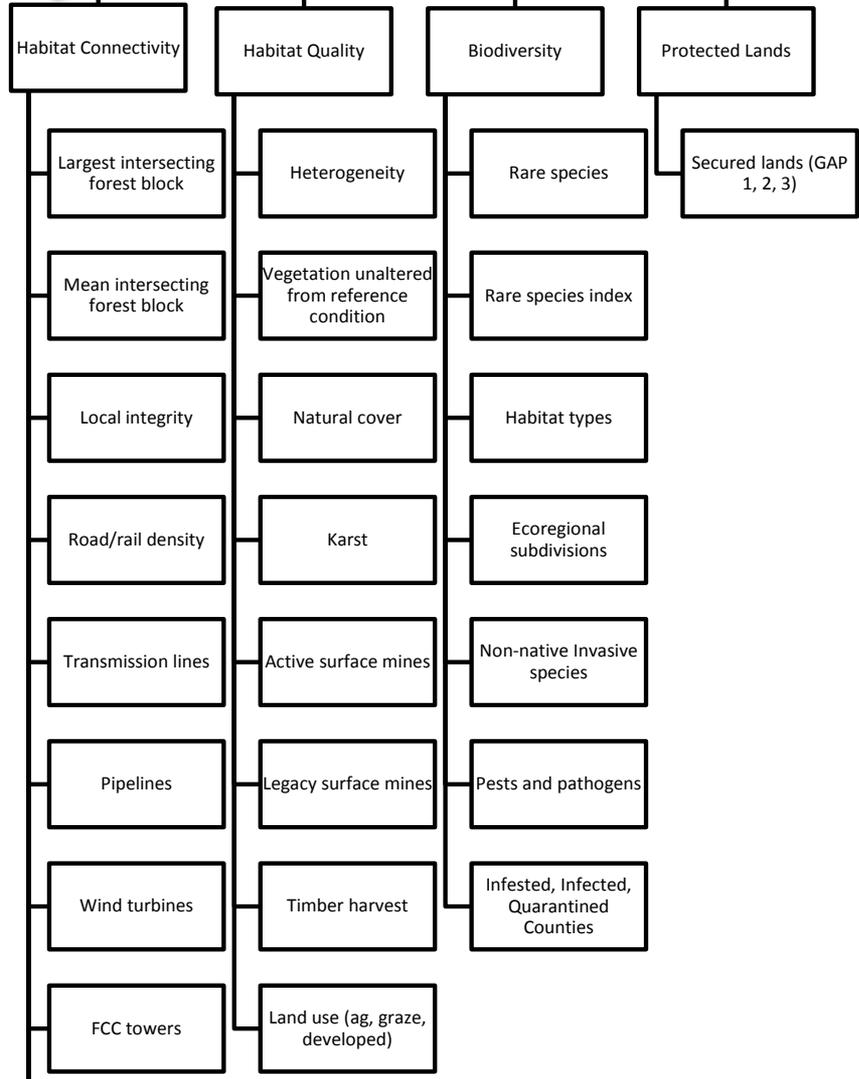
1 of 3 Models

UPLAND FORESTS PRIORITY MODEL

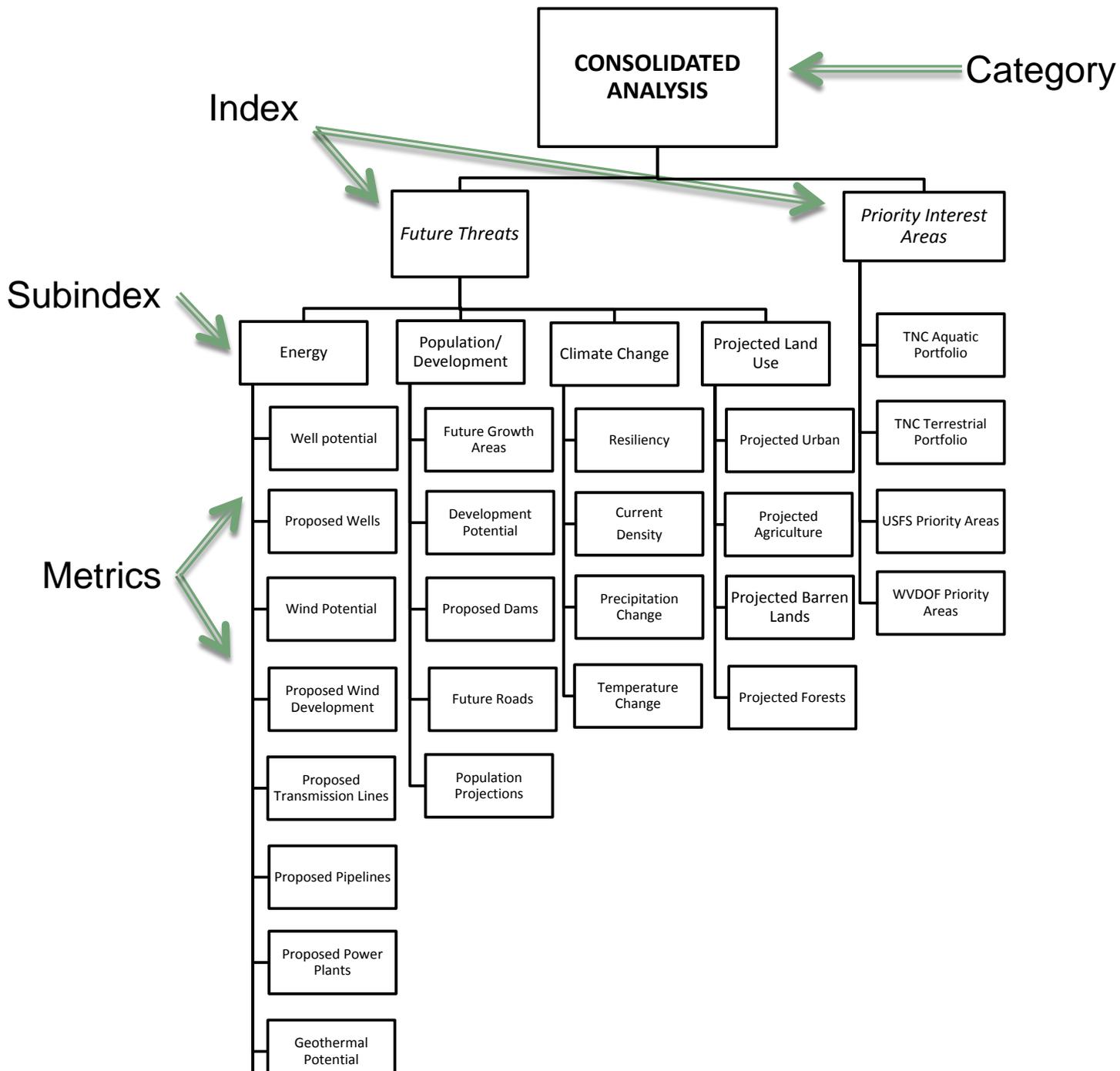
Index

CONDITION/ FUNCTION

Category



Metrics



Redundant Metrics

- Perform Correlation Analysis to find highly correlated metrics
- Performed on HUC12 analysis
- Eliminated several metrics
- Further elimination of metrics through statistical analysis

Weighting

- Some metrics influence condition more than others – need to weight accordingly
- Preliminary weighting based on literature review, expert opinion, and “best guess”
- Hoping to use Statistical Analyses to inform weighting of metrics in model
- Weighted both individual metrics and individual indices

Scores: Metrics, Indices, Models

- Metrics analysis resulted in a score for each metric
- For index scores: averaged all metrics according to metric weights
- For model scores: averaged all indices according to index weights
- Resulted in Ranks for each index and model

Relative vs. Objective Classification

- Relative ranking compares planning units with each other, but gives no information on which are good quality and which are not
- Need to define Thresholds for each metric to be able to assign to a category
- Literature review has only yielded a handful of objective thresholds
- Currently exploring using WV DEP's reference streams to define thresholds

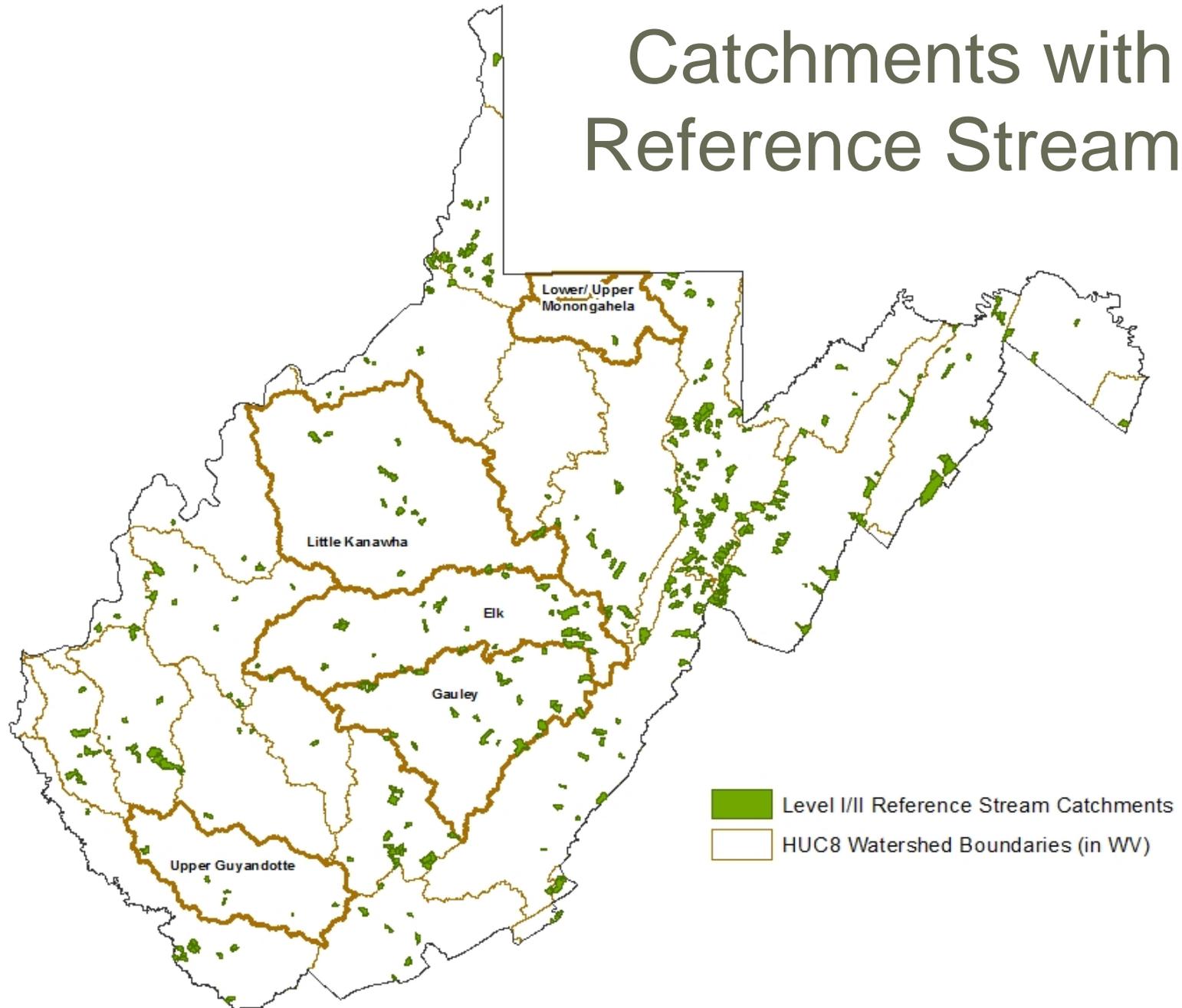
Threshold Categories

- **Very Good:** Ecologically desirable status; requires little intervention for maintenance
- **Good:** Indicator within acceptable range of variation; some intervention required for maintenance

Restoration Threshold

- **Fair:** Outside acceptable range of variation; requires human intervention
- **Poor:** Restoration increasingly difficult; may result in extirpation of target

Catchments with Reference Streams





FEEDBACK/QUESTIONS?

Condition/Function

1. Streams & Riparian Areas
2. Wetlands
3. Uplands

Indices: Streams

CONDITION/
FUNCTION

- Water quality
- Water quantity
- Hydrologic Connectivity
- Biodiversity
- Riparian Habitat
- Protected Lands

Water Quality Metrics

- DEP's Water Quality Data
- GLIMPSS
- Surface & Underground Mining
- Impervious Surface
- Landuse/Landcover:
 - Agricultural
 - Grazed
 - Natural
 - Developed
- Karst
- Oil and Gas Wells
- Road/railroad density

Water Quantity Metrics

- No good direct measurements for most streams, especially headwaters, had to find surrogates:
 - Dam drainage area
 - Impervious surface
 - Large Quantity users
 - Mining: Surface & Underground

Hydrologic Connectivity Metrics

- Unimpeded Streams (stream lengths without impoundments or waterfalls)
- Percent riparian area with forested cover
- Culverts (road/railroad crossings)
- Bridges
- Percent of stream miles that are headwaters

Biodiversity Metrics

- Rare and threatened species (includes DNR's SGNC species), including mussels, fish, crayfish, odonates
- Rare species index (calculated from # geology classes, elevation range, calcareous bedrock)
- Trout streams
- Non-native invasive species

Riparian Habitat Metrics

- Riparian land use
- Active surface mining
- Oil and gas wells
- Road/railroad density
- Pipelines, transmission lines, buildings

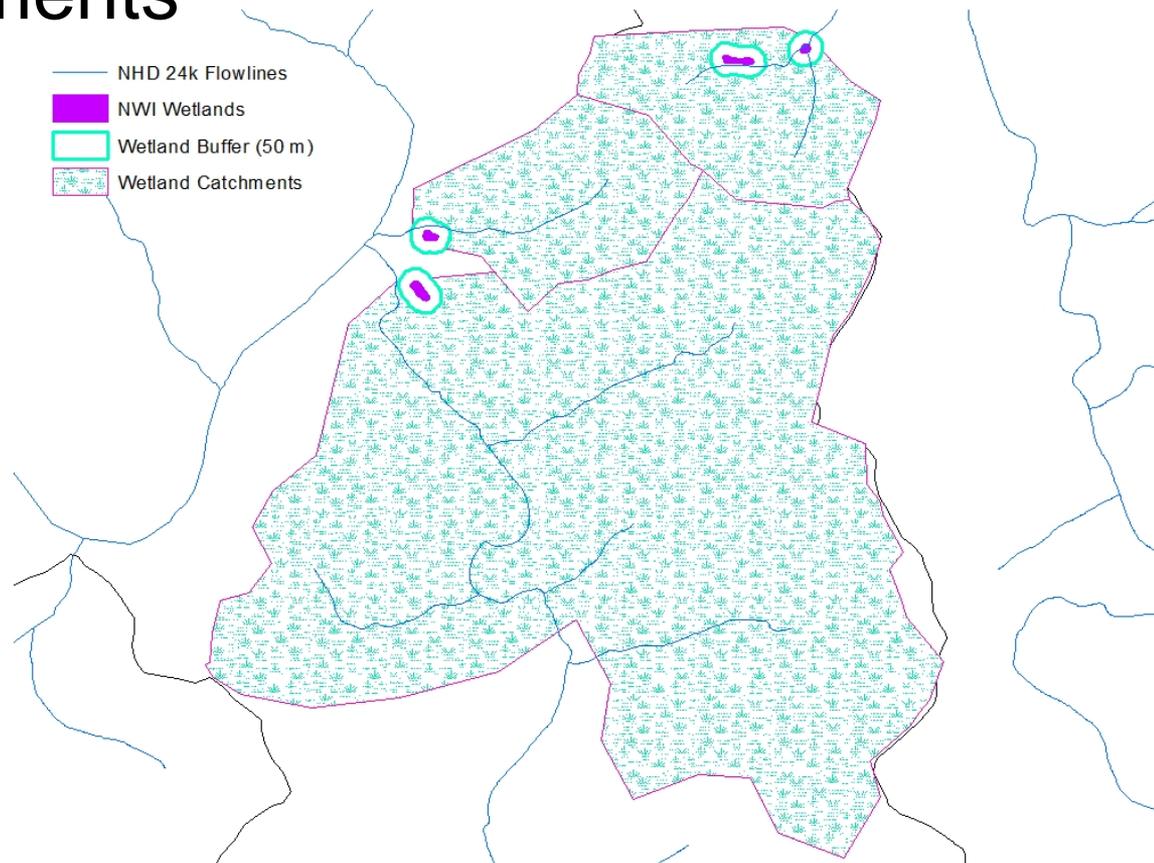
Indices: Wetlands

CONDITION/ FUNCTION

- Water quality: Pollutant filtration/sediment retention
- Hydrology: Flood storage/connectivity
- Biodiversity
- Wetland Habitat
- Protected Lands

Wetland Buffer vs. Catchment

- Wetland buffer (50 m)
- Wetland catchments
(delineated using contributing NHDPlus catchments)



Water Quality Metrics

- Forested headwater wetlands
- Landcover in wetland catchments (% ag, grazing, urban, forested, natural)
- % imperviousness in catchment
- Roads/railroads in catchment
- Mining and oil & gas wells in catchment
- Septic systems, landfills, timbering in catchment

Wetland Hydrology Metrics

- Wetland area and size
- Ratio of wetland catchment area to wetland area
- Distance to nearest surface water
- Hydric soils
- Forested flood plain wetlands
- Floodplain area

Indices: Uplands

CONDITION/
FUNCTION

- Habitat Connectivity
- Upland Habitat
- Biodiversity
- Protected Lands

Habitat Connectivity metrics

- Forest Block Sizes
- Active surface mining, coal production
- Oil & gas wells
- Road/railroad density
- Transmission lines, pipelines
- Wind turbines, FCC towers
- Buildings, landfills
- Timber harvests



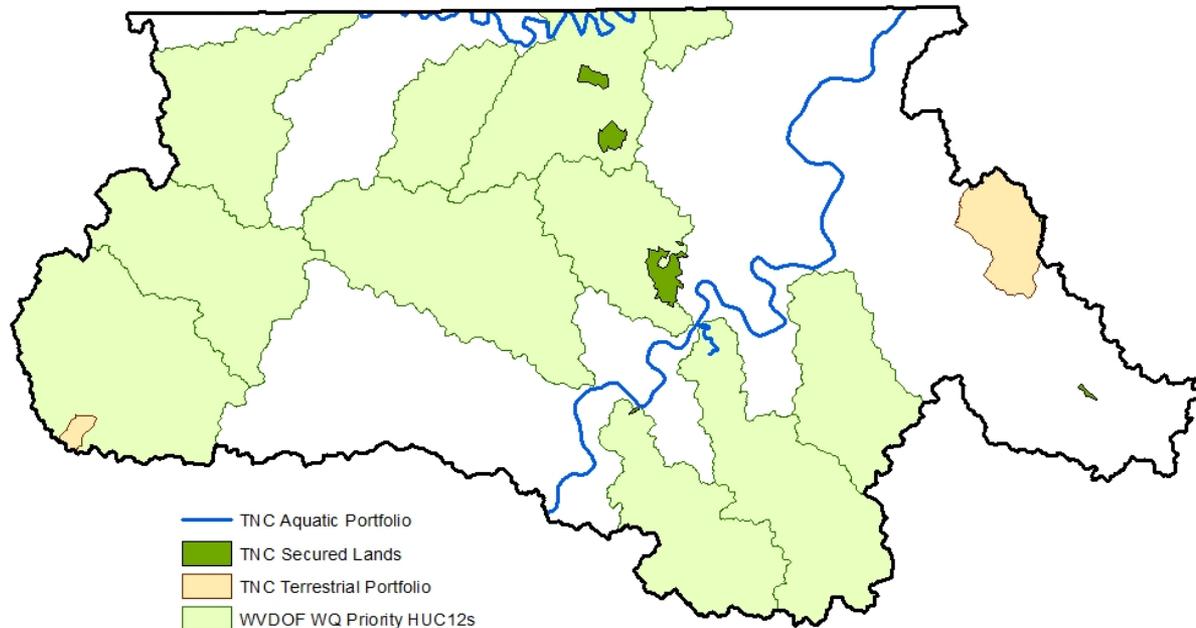
FEEDBACK/QUESTIONS?

Consolidated Analysis

1. Priority Interest Areas
2. Future Threats

Priority Interest Areas

- USFS Forest Proclamation Boundary
- WV Division of Forestry priority areas
- TNC aquatic and terrestrial portfolios



Future Threats

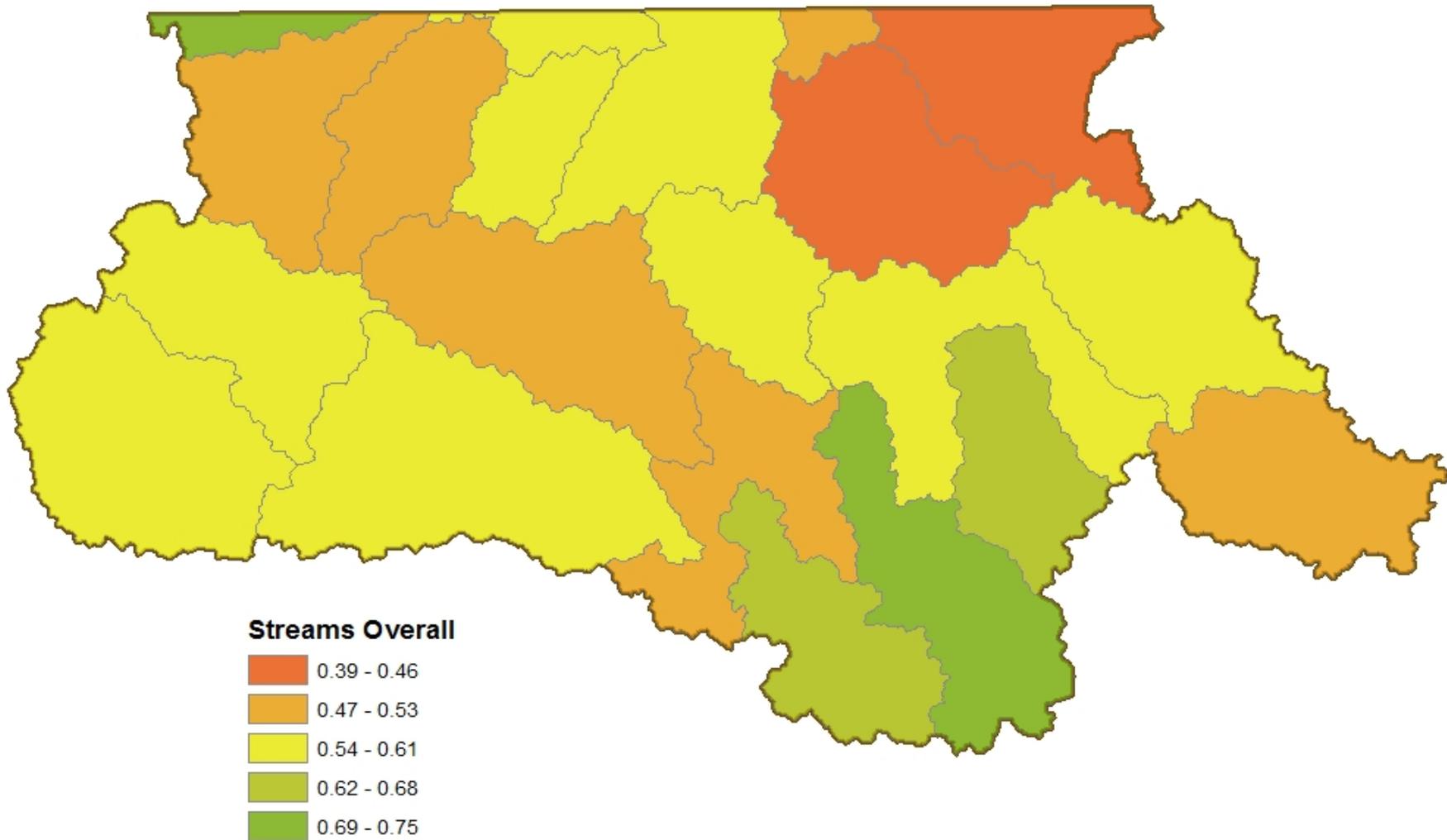
- Energy
 - Marcellus Shale thickness, proposed wells
 - Unmined coal, permitted mines
 - Wind potential
 - Proposed transmission lines, pipelines
- Population/Development
 - Future Growth Areas/Population projections
 - Proposed Roads
- Climate Change
- Projected Land Use
 - Projected Agriculture/mining/urban development

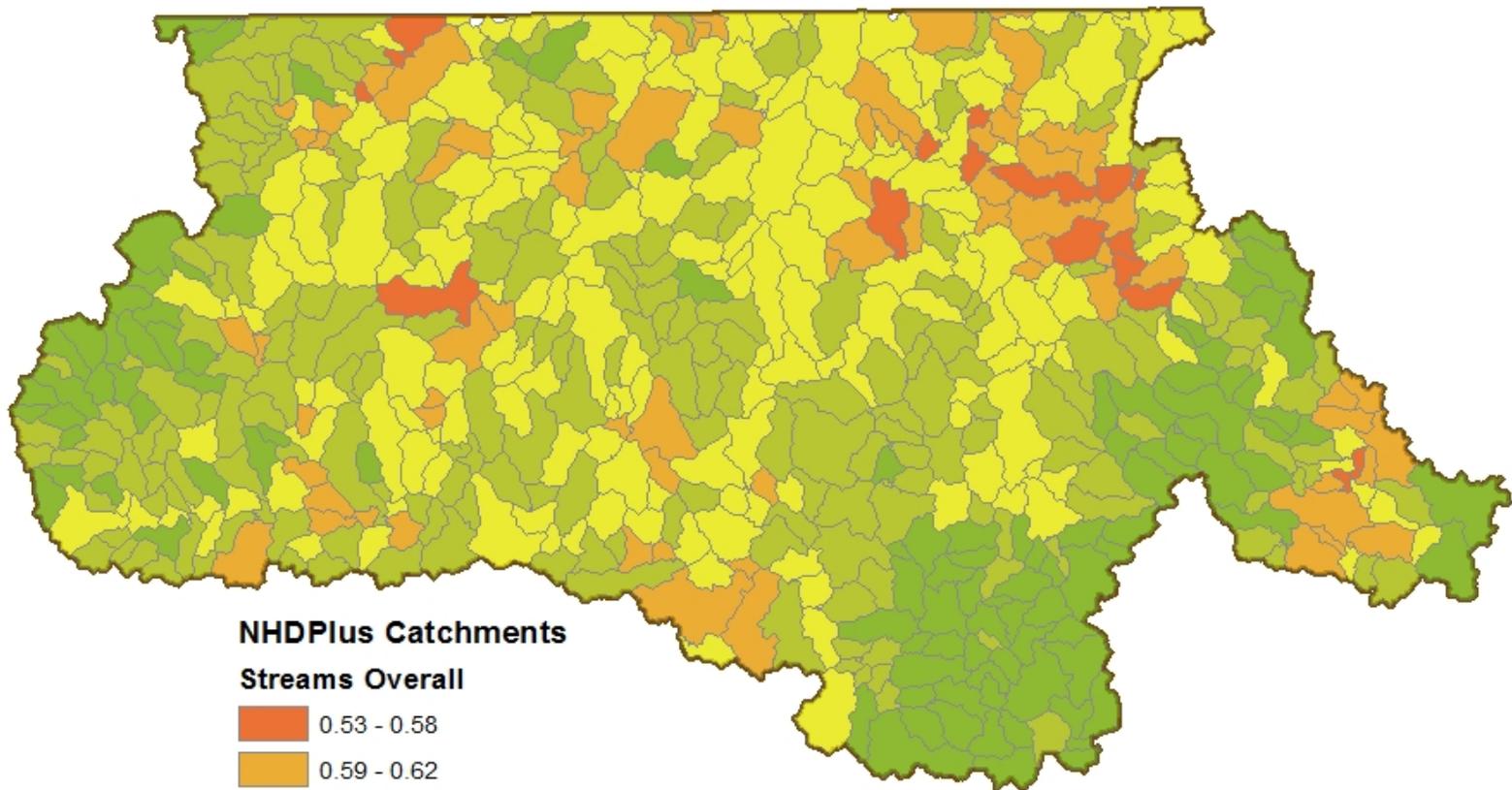
Monongahela Watershed

Results:
Relative Rankings

Legend Explanation

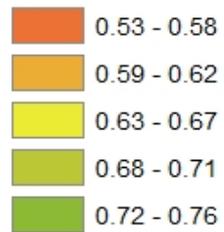
- This is a relative ranking of planning units
- Planning unit scores are divided into 5 categories and colored red - green for ease of comparison among each other:
 - Red does not necessarily mean “bad” (it does, however, mean worse than the others)
 - Green does not necessarily mean “good” (it does, however, mean better than the others)

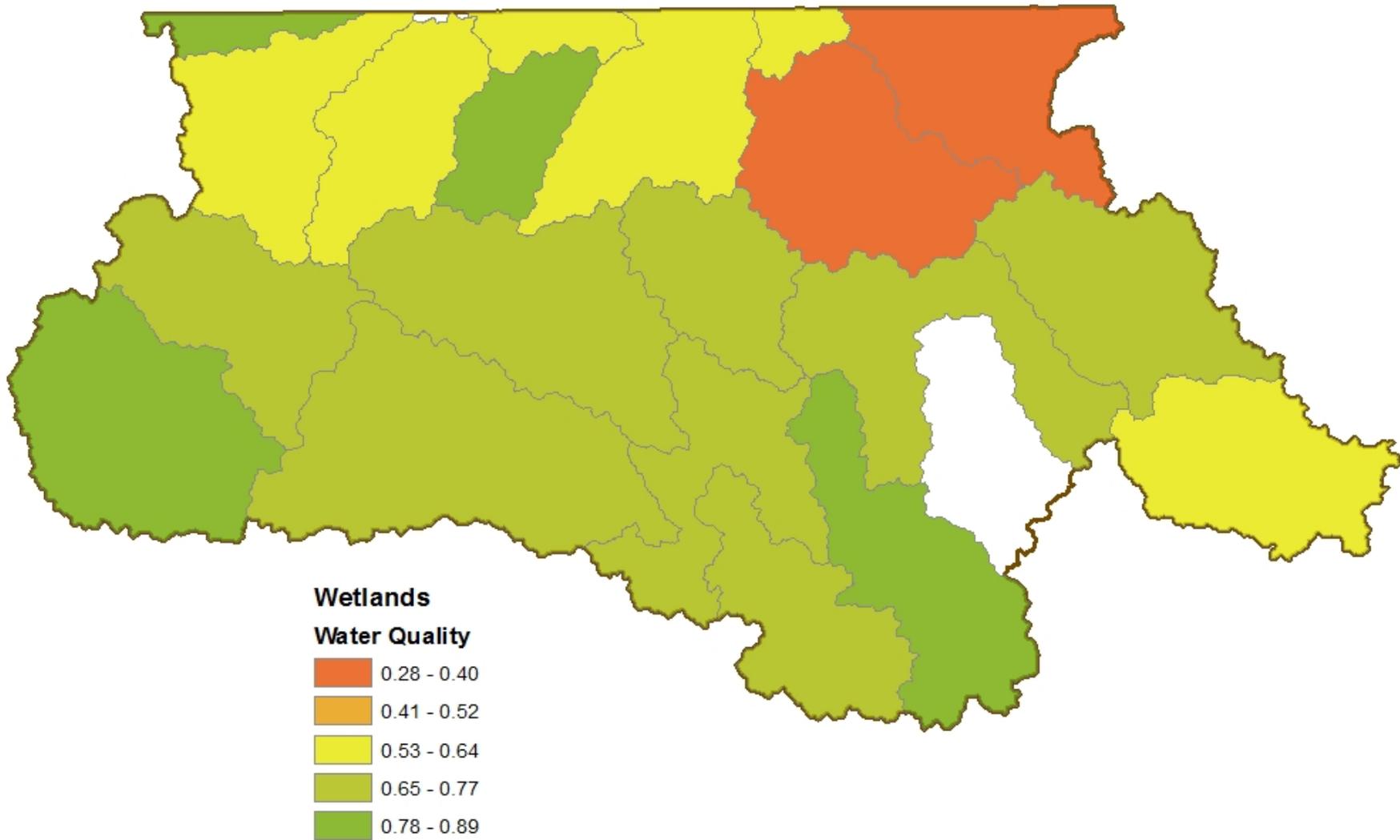


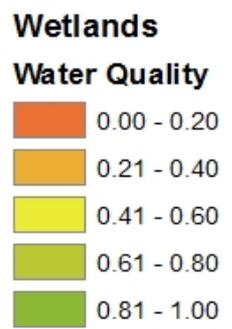
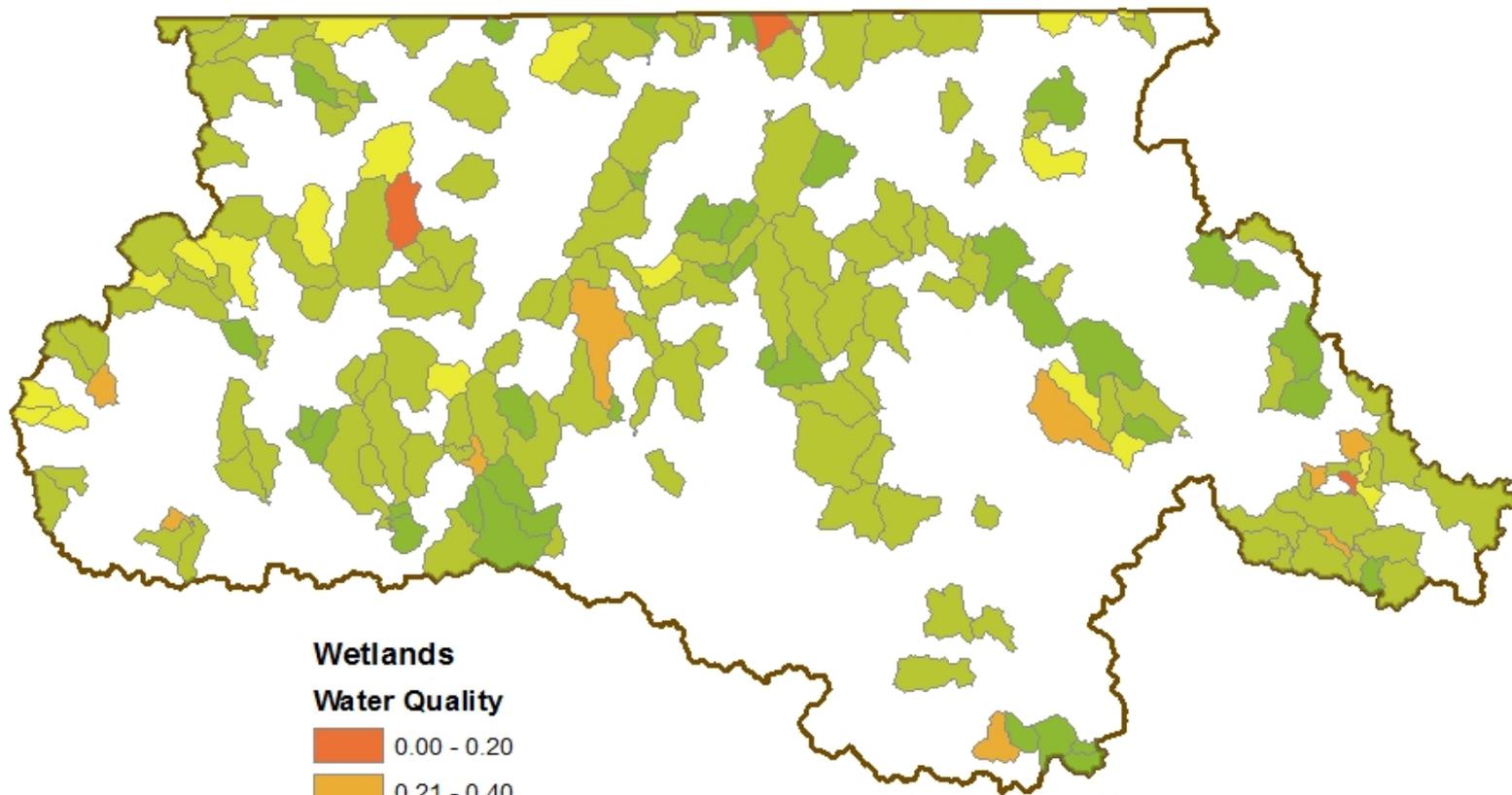


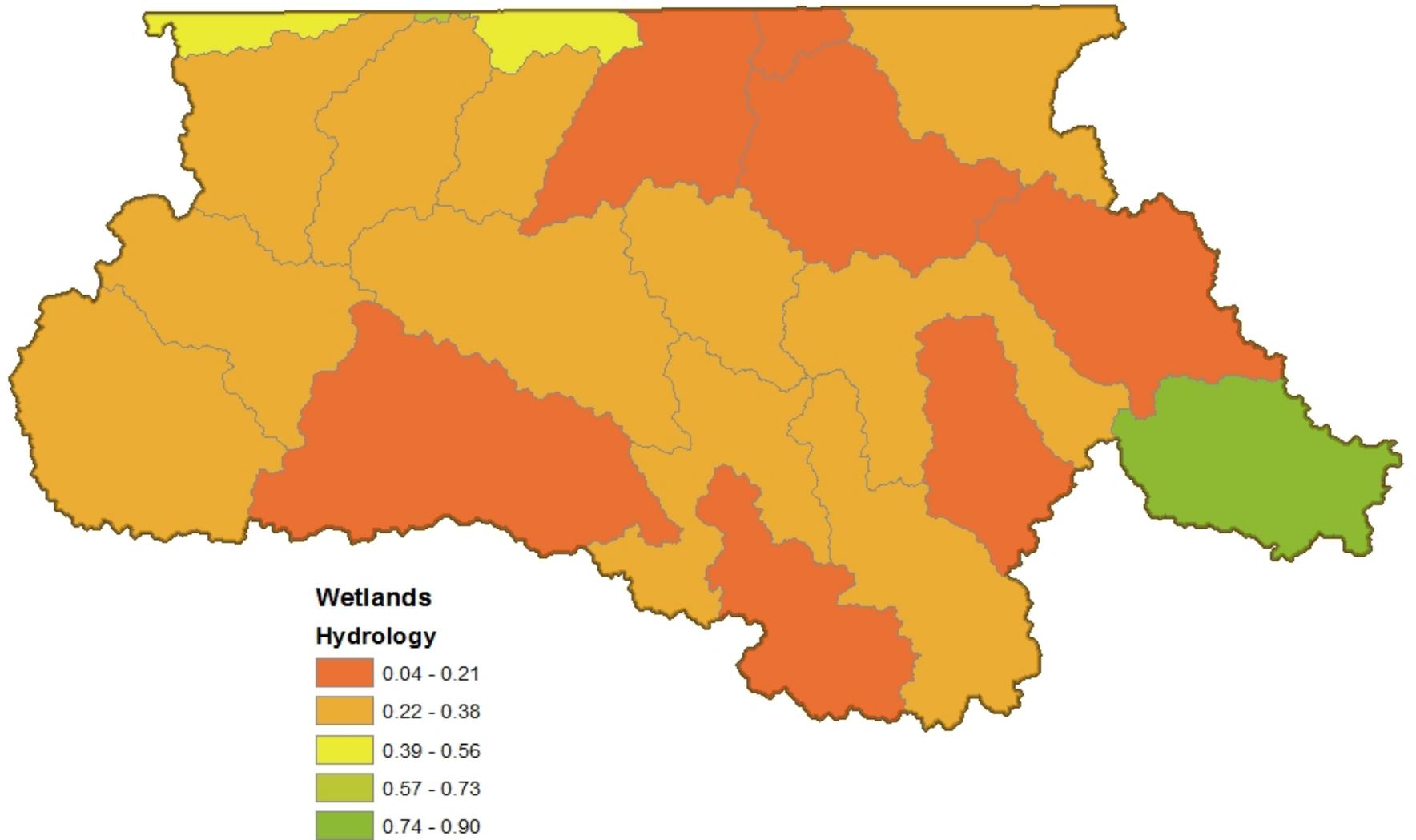
NHDPlus Catchments

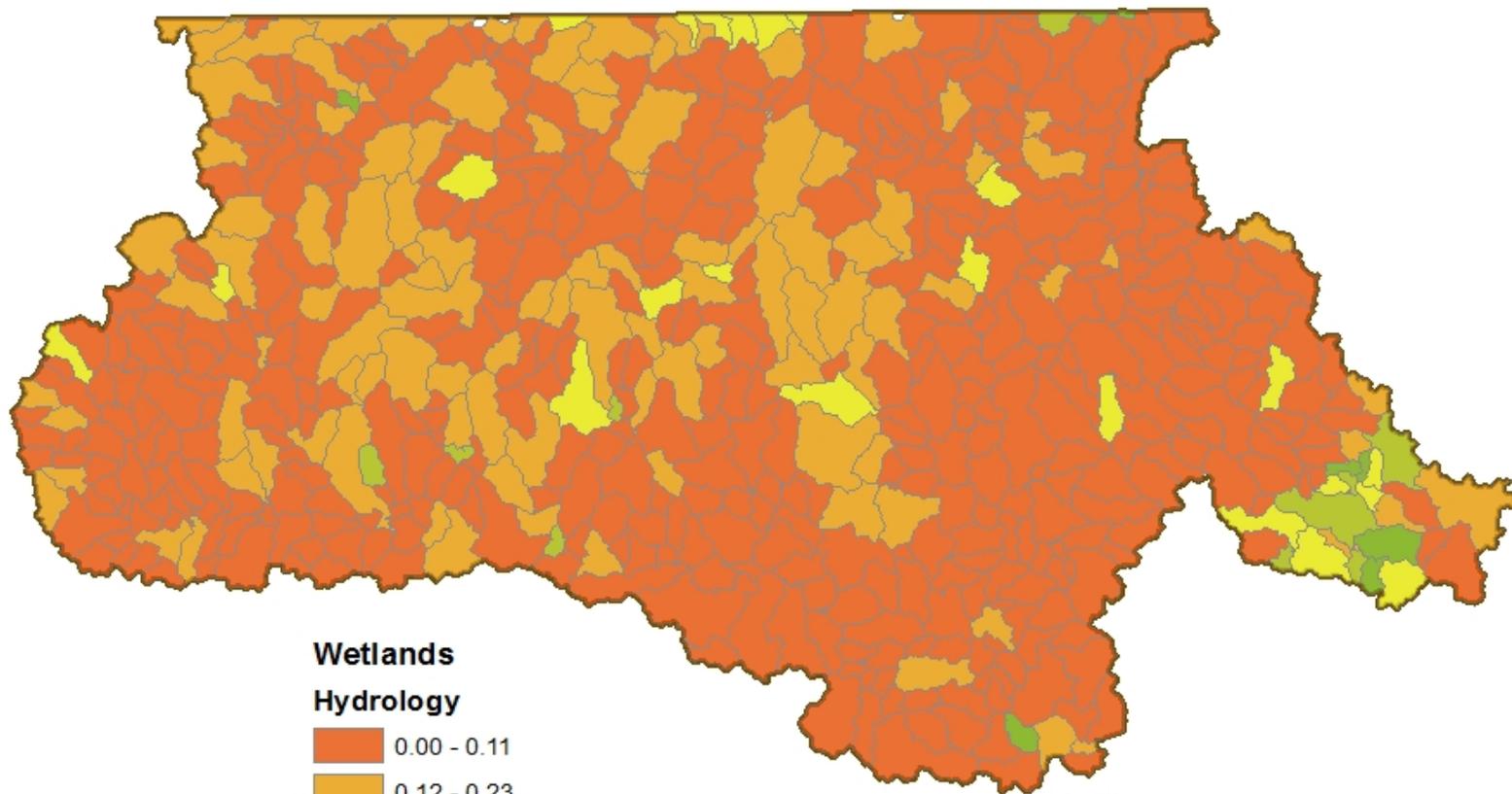
Streams Overall





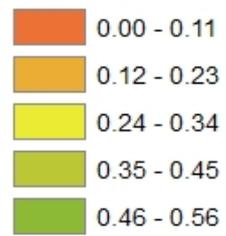


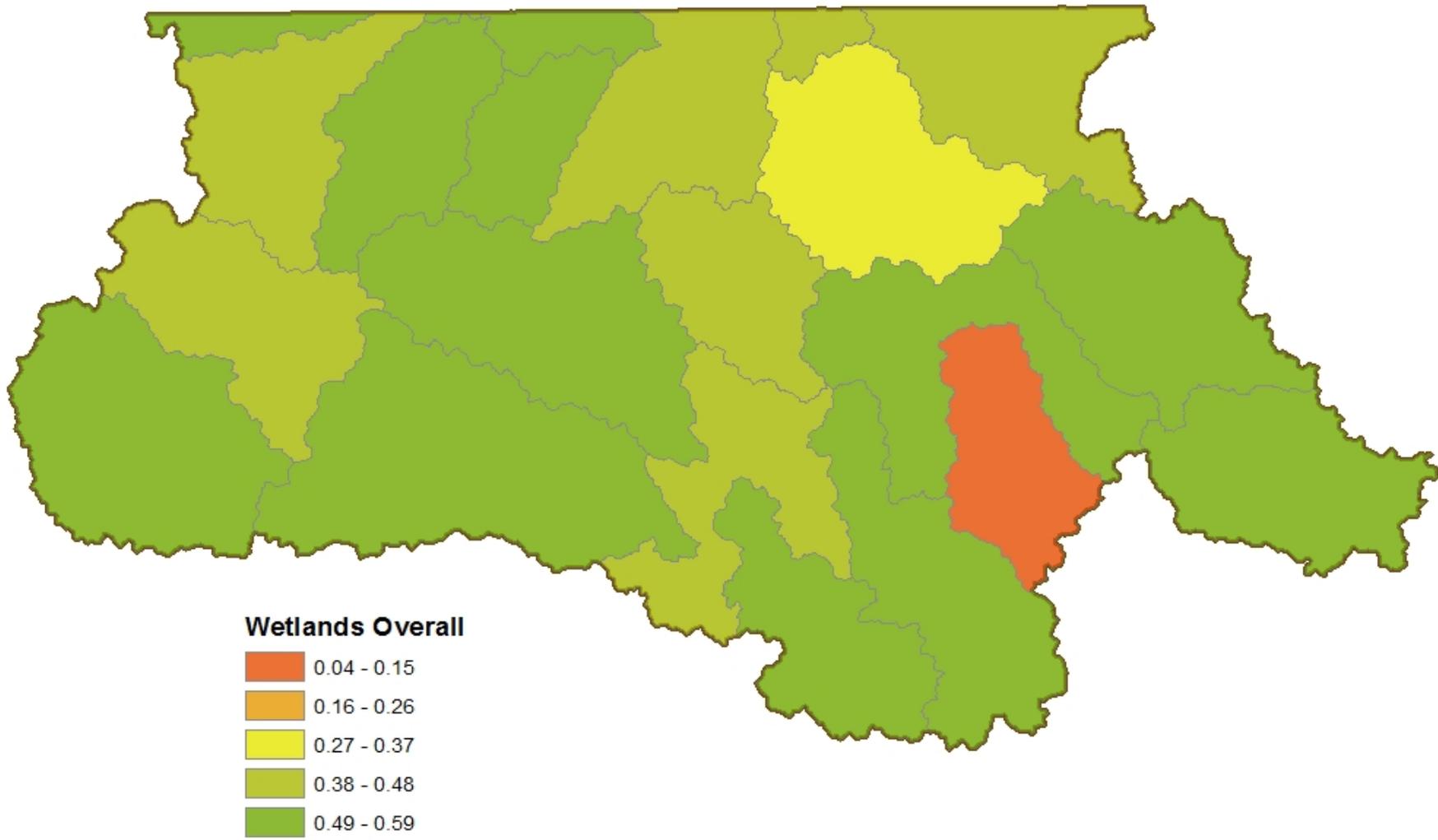


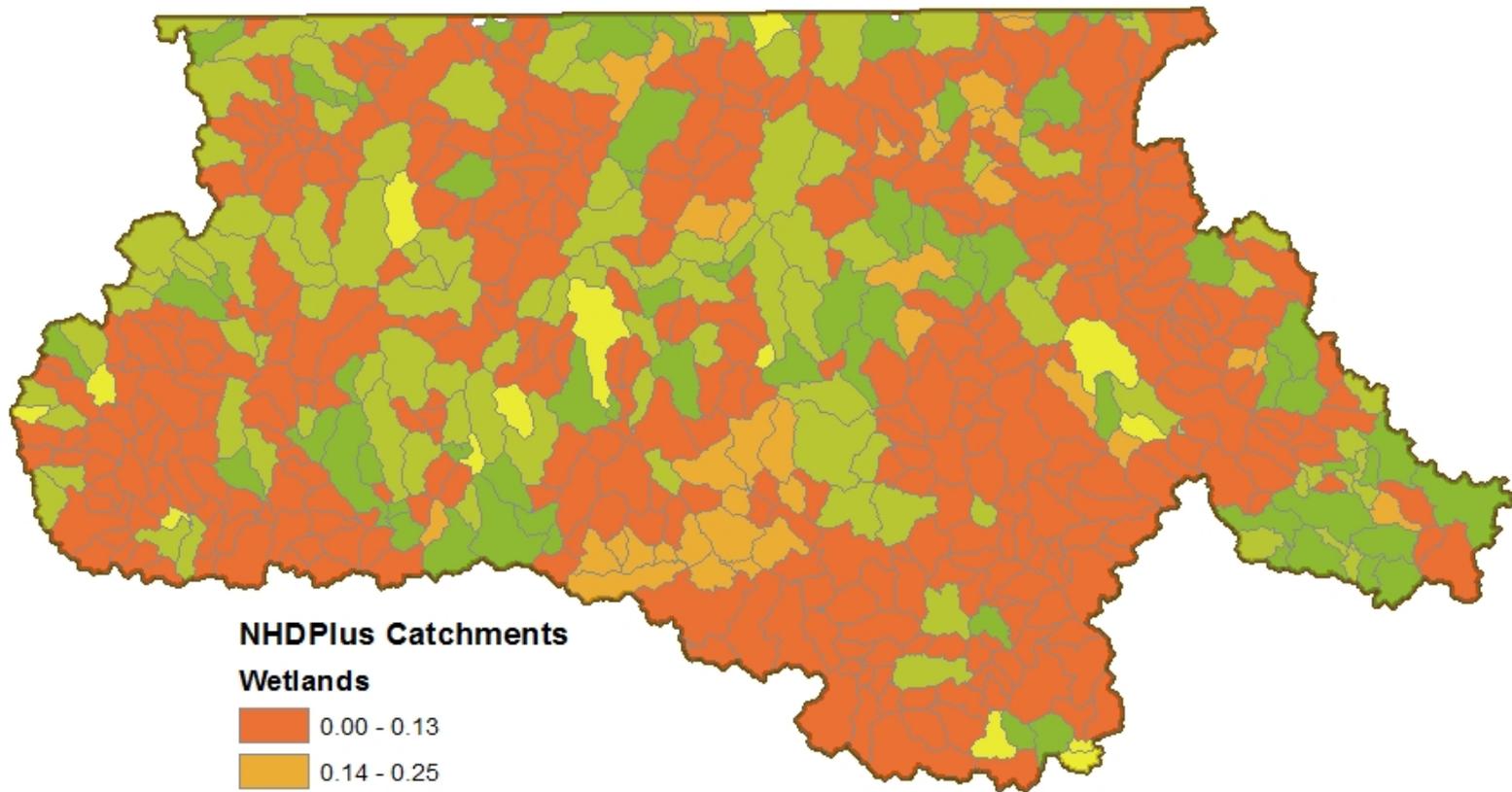


Wetlands

Hydrology



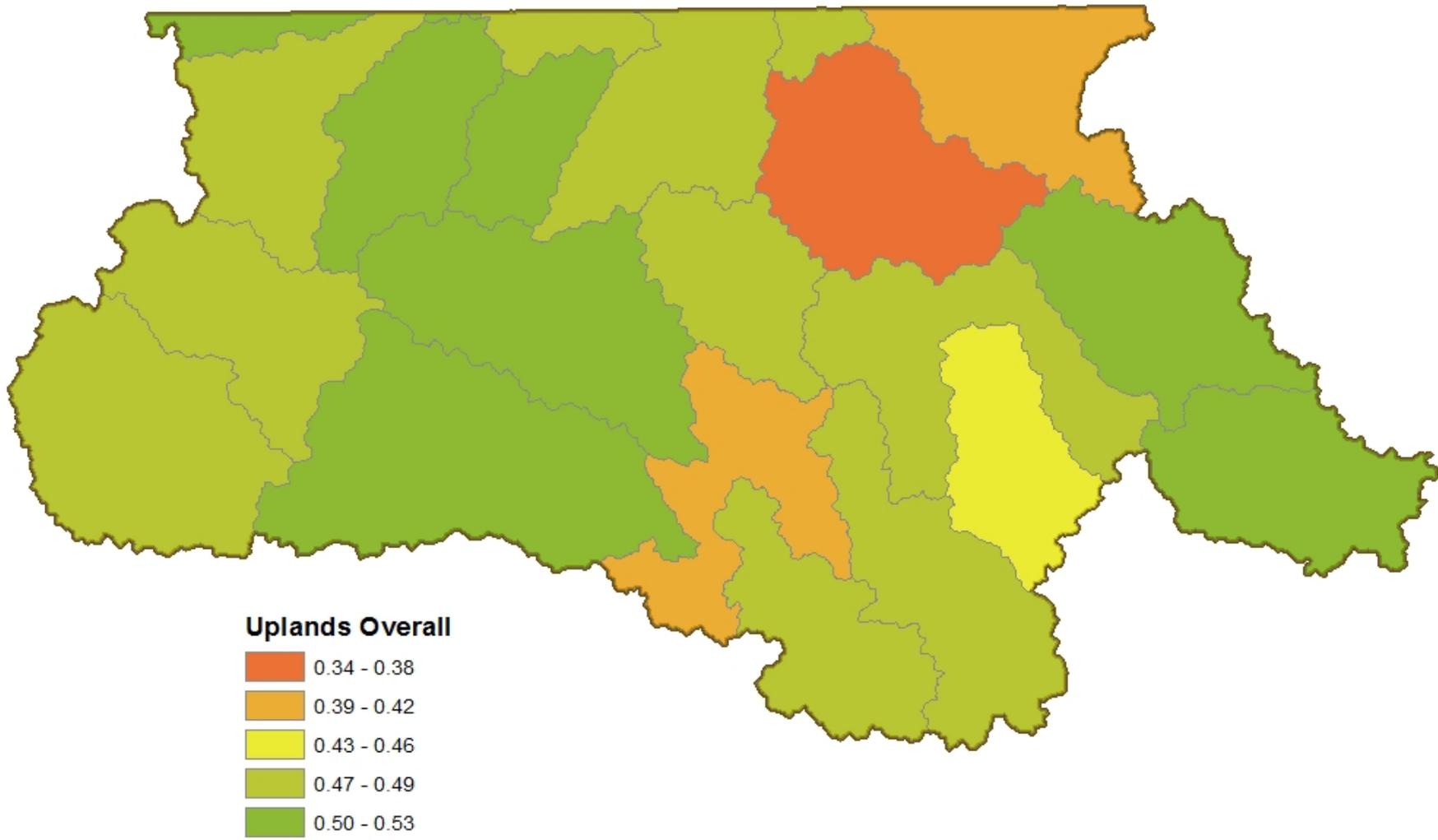


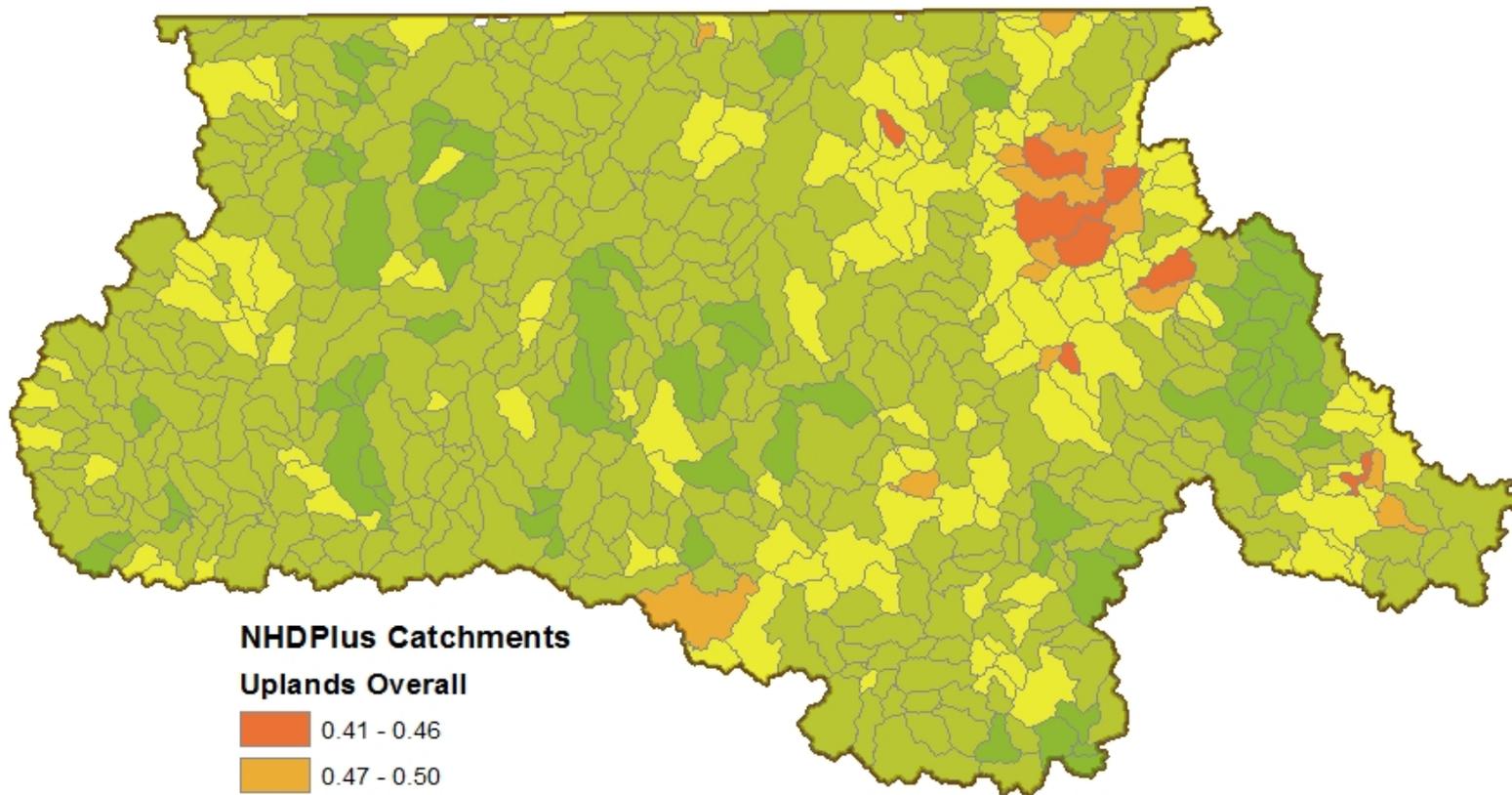


NHDPlus Catchments

Wetlands







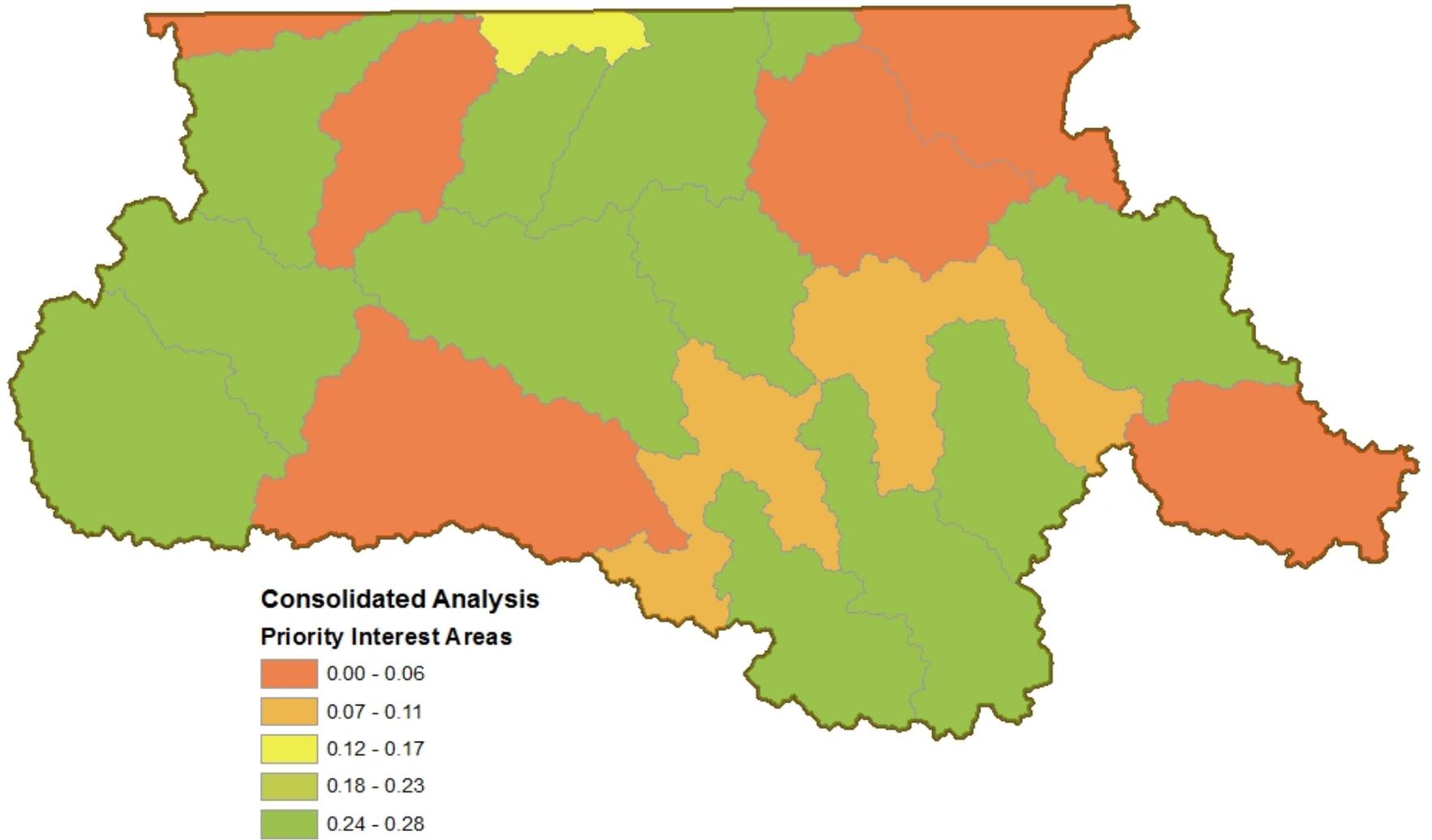
NHDPlus Catchments

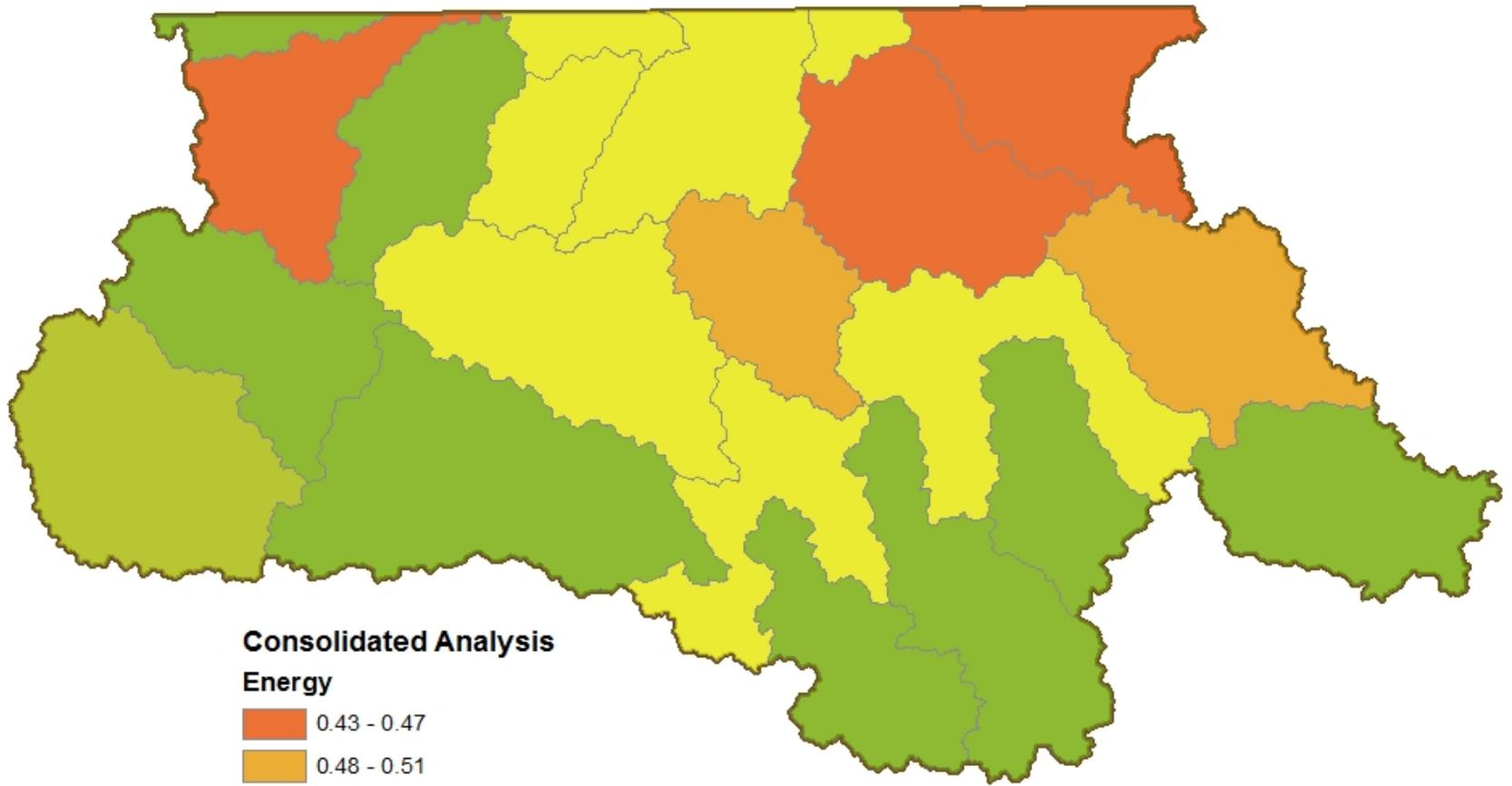
Uplands Overall

- 0.41 - 0.46
- 0.47 - 0.50
- 0.51 - 0.55
- 0.56 - 0.60
- 0.61 - 0.64

Monongahela Watershed

HUC12 Results: Consolidated Analysis

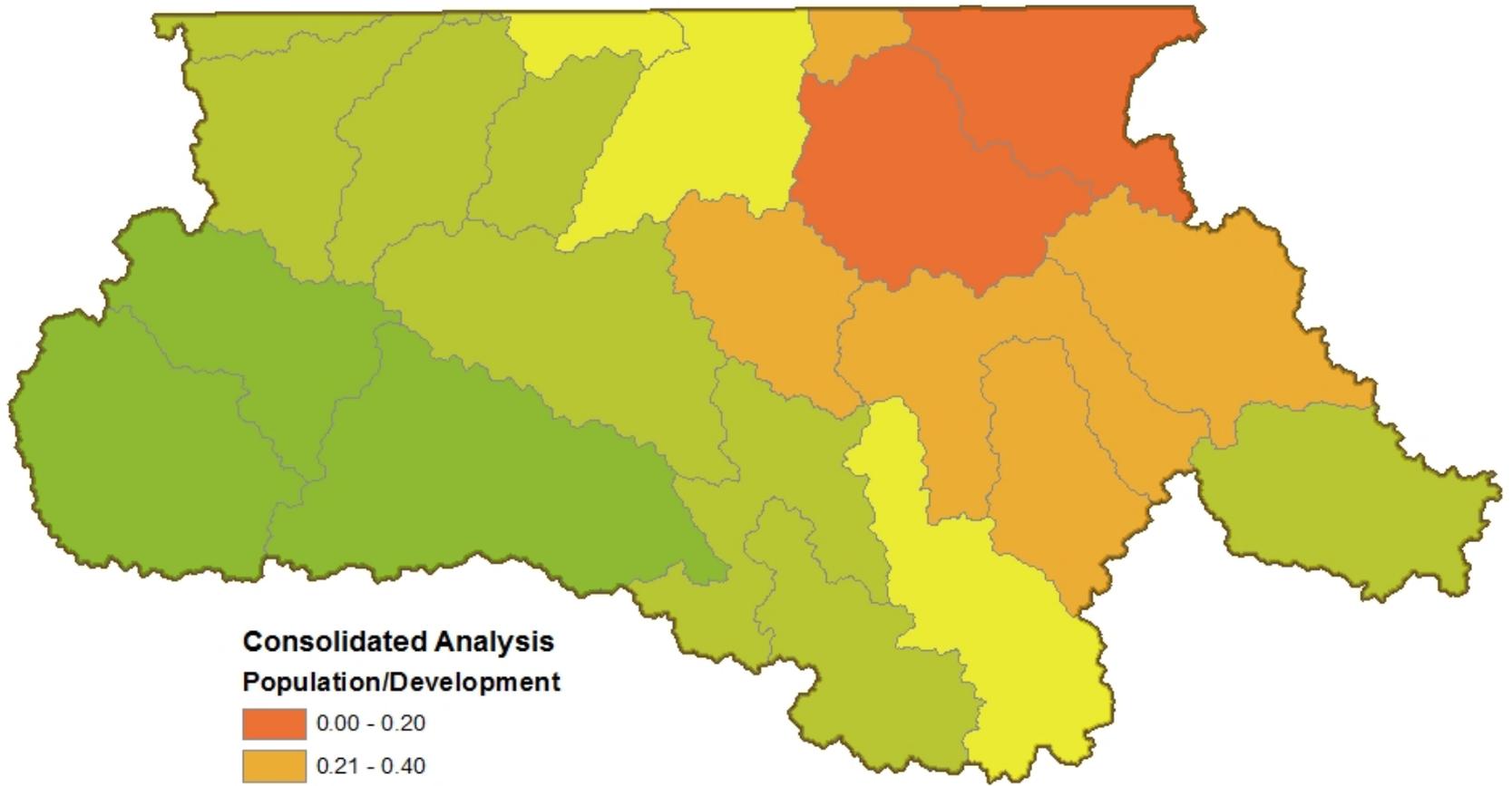




Consolidated Analysis

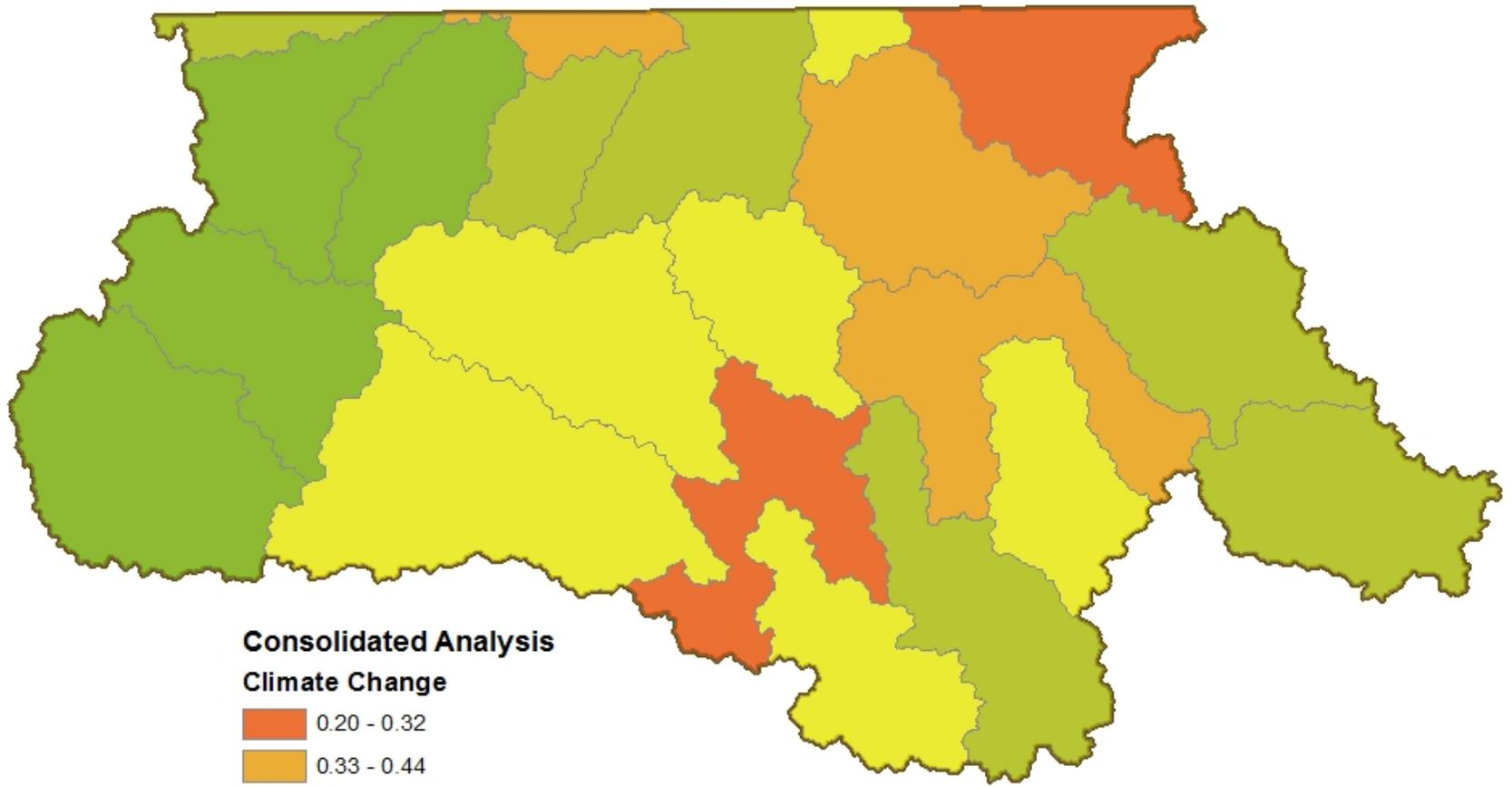
Energy

- 0.43 - 0.47
- 0.48 - 0.51
- 0.52 - 0.55
- 0.56 - 0.59
- 0.60 - 0.63



**Consolidated Analysis
Population/Development**

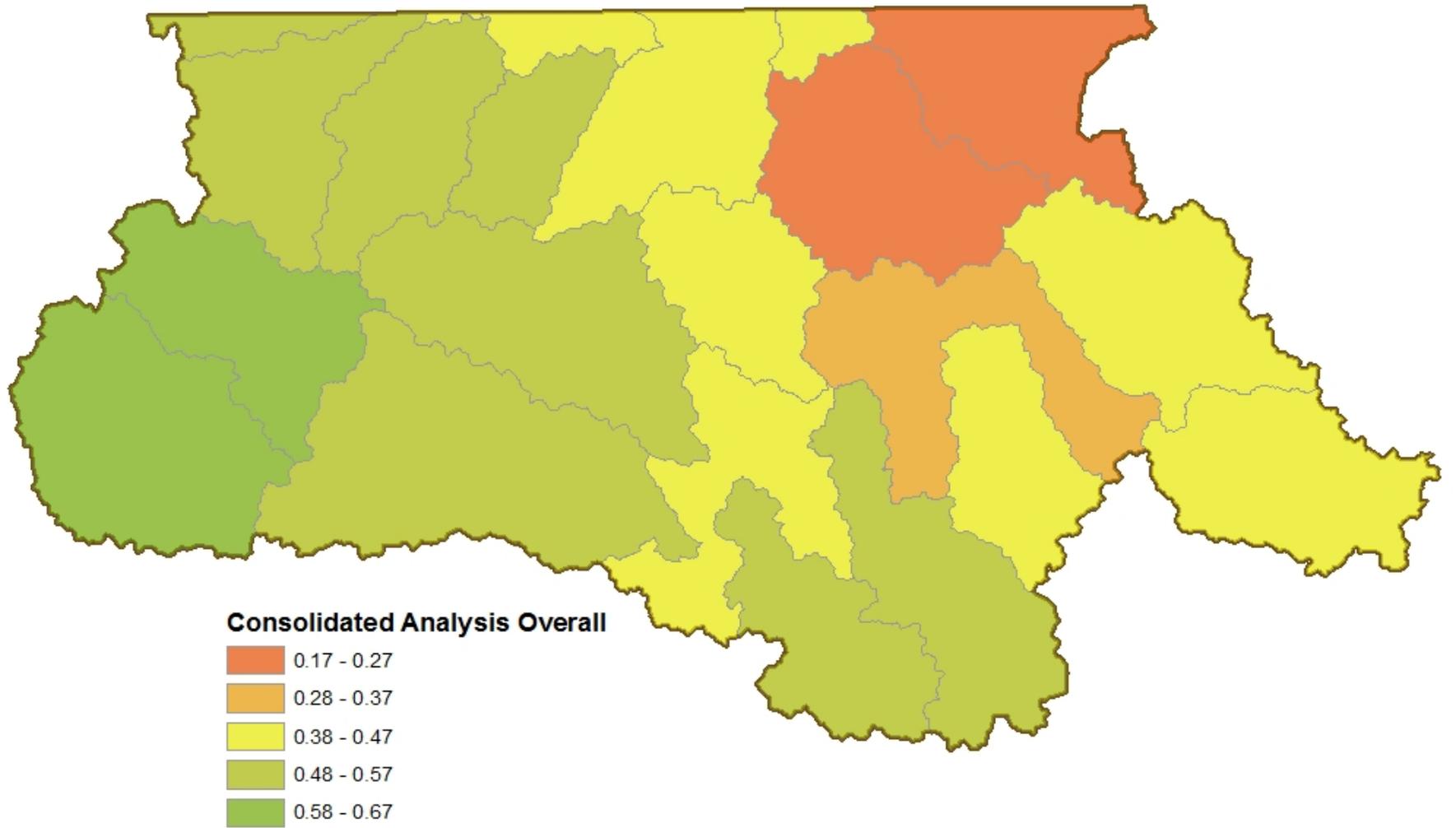
0.00 - 0.20
0.21 - 0.40
0.41 - 0.60
0.61 - 0.80
0.81 - 1.00



Consolidated Analysis

Climate Change

- 0.20 - 0.32
- 0.33 - 0.44
- 0.45 - 0.56
- 0.57 - 0.68
- 0.69 - 0.80



Word of Caution

- This is purely a GIS-based analysis with no field verification
- Suggested Strategy for selecting potential protection/restoration sites:
 - Select several candidate planning units for further verification
 - Conduct site visits to evaluate current conditions on the ground
 - Make final decision based on results from tool and site visits



FEEDBACK/QUESTIONS?